

Plant Document Analysis

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End of Engineering Analysis Report

ENGINEERING SPECIFICATION ANALYSIS

Focus Area: Design Temperature

Generated on December 03, 2025

Accepted Specifications for Evaluation of Design Temperature

- "Design Temperature (DBT) for Air Coolers: 41° C" (Section 7.2.2)
- "Electrical Design Temperature 43° C for equipment located outdoors." (Section 7.2.2)
 - "Electrical Design Temperature 40°C for equipment located indoors and lighting fittings located outdoors" (Section 7.2.2)
- "Design Surface Temperature: 65° C **" (Section 7.2.2)
- "Winterizing Temperature: 10° C †" (Section 7.2.2)
- "Low Ambient Design Temperature 7.5° C ‡" (Section 7.2.2)
 - "Design Temperature shall be 28 ° C (50 ° F) plus the coincidental temperature at the Design Pressure." (Section 9.5.2 — verbatim from document)
 - "For temperatures beyond 3430 ° C (6500 ° F), the Design Temperature shall be 14 ° C (25 ° F) plus the coincidental temperature at the Design Pressure." (Section 9.5.2 — verbatim from document)
 - "For equipment that may be under the purview of PESO, the minimum design temperature on the positive side shall not be less than 650 ° C." (Section 9.5.2 — verbatim from document)
 - Minimum Design Metal Temperature (MDMT) rules: "The minimum design metal temperature for new design units is the most stringent of the following:
 - The minimum ambient temperature less 5.6 ° C (10° F).
 - The minimum operating temperature less 5.6 ° C (10° F).
 - The minimum equipment temperature caused by depressuring down to the constant superimposed back pressure of the flare header." (Section 9.5.3)
 - Vacuum/steam-out design temperature guidance: "Columns and vessels subjected to steam out to be designed for at least half vacuum (0.5 kg/cm² a)." and "Steam condensers, steam reboilers or heaters, condensate pots, direct steam injection equipment to be designed for full vacuum." (Section 9.5.4) — (related design temperature/pressure regime guidance)

- Air cooler design ambient for sizing: "For air coolers use 41 °C ambient air dry bulb temperature." (Section 9.7.6)
 - Air cooler process temperature breakpoint: "The preferred process temperature breakpoint between air and water cooling when air cooled exchange is followed by water cooled exchange is 55 0 C." (Section 9.7.6)
- Steam battery-limit design temperatures (Attachment 3):
 - HHP Steam: Normal 510 °C; Design 540 °C (table: HHP Steam 490/510/515/540 entries) (Attachment 3, Steam Battery Limit Conditions)
 - HP Steam: Normal 383 °C; Design 426 °C (Attachment 3)
 - MP Steam: Normal 232 °C; Design 288 °C (Attachment 3)
 - LP Steam: Normal 158 °C; Design 260 °C (Attachment 3)
 - Boiler Feed Water battery-limit temperatures: "HHP/HP/MP/LP BFW: Normal 121 °C ; Design 150 °C" (Attachment 3, Boiler Feed Water Battery Limit Conditions)
 - Condensate saturation temperatures correspond to pressures (Attachment 3): e.g., HP Condensate Normal 254 °C; Design 261 °C; MP Condensate Normal 203 °C; Design 217 °C; LP Condensate Normal 152* °C; Design 175* °C (Attachment 3) — values listed in condensate battery-limit table
 - Cooling water design temperatures (Attachment 3): Fresh cooling water supply Normal 32 °C; Return Normal 45 °C; Max outlet temperature of exchanger 49 °C; water-side design temperature 120 °C (Cooling Water Battery Limit Conditions table)
 - Potable water battery-limit: user normal 35 °C; max 43 °C; design 65 °C (Attachment 3, Potable Water Battery Limit Conditions)
 - Fire water: Normal 35 °C; Max 43 °C; Design 65 °C (Attachment 3, Fire Water Battery Limit Conditions)
 - Fuel gas battery-limit temperatures: Fuel Gas Normal 38 °C; Max 94 °C; Design 120 °C (Attachment 3, Fuel Gas Battery Limit Conditions)
 - Plant/Instrument/Breathing air battery-limit temperatures: Normal 40 °C; Design 65 °C (Attachment 3, Plant Air / Instrument Air battery-limit table)
 - Demineralized / Raw / Desalinated water specification sheets reference "Normal Supply Temperature" entries (Attachment 2) for various water utilities (multiple tables in Attachment 2 show supply/normal temperatures, e.g., Sea water Normal Supply Temperature 25–35 °C; DSW Normal Supply Temperature 40–45 °C; Desalinated water Normal = Ambient) — these are temperature parameters relevant to design temperature verification.

Measurements Provided in Document

- Air cooler design ambient temperature: 41 °C (Section 7.2.2; Section 9.7.6)
- Design Surface Temperature: 65 °C (Section 7.2.2)

- Electrical design temperatures: 43 °C (outdoor), 40 °C (indoor) (Section 7.2.2)
- Winterizing Temperature: 10 °C (Section 7.2.2)
- Low Ambient Design Temperature: 7.5 °C (Section 7.2.2)
 - "Design Temperature shall be 28 0 C (50 0 F) plus the coincidental temperature at the Design Pressure." (Section 9.5.2) — procedural numeric baseline
 - Elevated-temperature clause: "For temperatures beyond 3430 C (6500 F), the Design Temperature shall be 14 0 C (25 0 F) plus the coincidental temperature at the Design Pressure." (Section 9.5.2) — verbatim numeric wording present in document
 - PESO-related minimum positive-side design temperature: "not be less than 650 C." (Section 9.5.2) — verbatim wording present in document
- MDMT rule values: ambient or operating temperature less 5.6 °C (10 °F) (Section 9.5.3)
- Steam battery-limit temperatures (numerical):
 - HHP Steam Normal 510 °C; Design 540 °C (Attachment 3)
 - HP Steam Normal 383 °C; Design 426 °C (Attachment 3)
 - MP Steam Normal 232 °C; Design 288 °C (Attachment 3)
 - LP Steam Normal 158 °C; Design 260 °C (Attachment 3)
 - Boiler Feed Water Normal 121 °C; Design 150 °C (Attachment 3)
- Condensate table values:
 - HP Condensate Normal 254 °C; Design 261 °C
 - MP Condensate Normal 203 °C; Design 217 °C
 - LP Condensate Normal 152 °C; Design 175 °C (Attachment 3; temperatures noted as saturation temperatures)
 - Cooling water battery-limit temperatures: supply 32 °C; return 45 °C; max outlet 49 °C; exchanger water-side design temperature 120 °C (Attachment 3)
 - Potable/Fire water normal and max temperatures: Normal 35 °C; Max 43 °C; Design 65 °C (Attachment 3)
 - Fuel Gas Normal 38 °C; Max 94 °C; Design 120 °C (Attachment 3)
 - Plant/Instrument Air Normal 40 °C; Design 65 °C (Attachment 3)
 - Sea water normal supply temperature 25–35 °C (Attachment 2)
 - Desalinated water normal supply temperature: "Ambient" (Attachment 2)
 - DSW from thermal desal units normal supply temp 40–45 °C (Attachment 2)
 - Demineralized water battery-limit: Design temperature 65 °C (Attachment 3)
 - Boiler feed water temperatures (HHP/HP/MP/LP) Normal 121 °C Design 150 °C (Attachment 3)

Inputs and Additional Requirements from Client (explicit in document)

- Instruction for default design temperature where not specified: "Where not specified elsewhere in this document, the Design Temperature shall be 28 0 C (50 0 F) plus the coincidental temperature at the Design Pressure." (Section 9.5.2) — client-specified baseline input
- Instruction for high-temperature cases: "For temperatures beyond 3430 C (6500 F), the Design Temperature shall be 14 0 C (25 0 F) plus the coincidental temperature at the Design Pressure." (Section 9.5.2) — client-specified alternate baseline
- PESO note: "For equipment that may be under the purview of PESO, the minimum design temperature on the positive side shall not be less than 650 C." (Section 9.5.2) — client requirement as stated
- MDMT selection rule: use the most stringent of three listed criteria (minimum ambient less 5.6 °C; minimum operating less 5.6 °C; minimum equipment temperature from depressuring) (Section 9.5.3) — client-specified rule
 - Steam-out/vacuum design requirements: equipment subjected to steam-out to be designed for at least half vacuum (0.5 kg/cm² a); steam condensers/reboilers/steam injection equipment to be designed for full vacuum (Section 9.5.4) — client-specified design condition inputs
 - Multiple statements that battery-limit temperatures/pressures and many design numbers "will be firmed up as system design progresses" or "to be verified during facility design" (Attachment 2/3 and multiple sections). Explicit calls-out in document that final coincidental temperatures, process upset temperatures, and battery-limit conditions are to be finalized later.
 - Attachment 3 provides numerous battery-limit design temperature values for utilities and services (steam, BFW, condensate, cooling water, potable/fire water, fuel gas, instrument/plant air, nitrogen) — these are client-supplied inputs to be used/finalized by OSBL designer as stated in the attachments.
- The document repeatedly directs that for ISBL items licensors' guidelines shall prevail (e.g., "This section ... shall be used for OSBL; for ISBL, licensors guideline shall be followed." Section 9.5.2 & 9.5.3) — explicit instruction affecting which design temperature source to use.
- Explicit note: "Design temperature for surfaces exposed to solar radiation." (asterisk associated with Design Surface Temperature 65°C) — indicates intended use but no further solar incident specifics provided.
- Missing / to-be-confirmed items explicitly stated in document (calls for additional data or clarification):
 - Coincidental temperatures at Design Pressure for equipment where the document provides the "28 °C + coincidental" rule — actual coincidental temperature values are not provided in the document and are to be determined during detailed design. (Section 9.5.2)

- Several Attachment 3 battery-limit condition tables include blank entries or statements "Where no number has been provided ... Designer shall populate the tables as design evolves." — explicit missing data for many pressure/temperature battery-limits (Attachment 3)
- Multiple tables in Attachment 2 / 3 have "To be confirmed" notes (explicitly stated) for several temperature-related entries (Attachment 2 and Attachment 3)
 - For steam/condensate/steam blowdown and condenser headers the document states "The temperatures and pressures of each level shown in Attachment 3 reflect the conditions at the battery limit of consumer plants. The OSBL designer shall ensure that these parameters are satisfied." — implying that confirmation of coincident temperatures at user battery limits is required (Sections 8.9.1 / Attachment 3)
 - For MDMT calculations under depressurizing, reference to API RP 579 is made for fitness-for-service but no specific depressurizing temperature values are provided in the document. (Section 9.5.3)
 - For equipment under PESO the numeric wording provided appears garbled ("650 C") — document flags PESO-related minimum design temperature requirement but gives a number that needs confirmation/clarification (Section 9.5.2)
 - Air cooler breakpoint (55 °C) and ambient selection (41 °C) are stated; however, many exchanger-specific design temperatures depend on licensor data and are to be validated (Section 9.7.6)

Notes on scope and provenance (document-only extraction)

- The above lists include only values, rules and requirements explicitly stated in the provided document (EPCMD-1-DBD-GE-001 and Attachments 2 & 3). No external values were added; external standards (ASME, API) are referenced in the document as governing codes for equipment design but specific external-code clauses were not quoted here beyond the document statements.

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